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ABSTRACT

Training in word recognition based on a child's dominant sensory modality (visual, auditory, or kinesthetic) was compared with training based on nondominant modality. Twenty-five first-grade children with no prior instruction in reading were given visual, auditory, and kinesthetic modalities tests and a pretest of recognition of the words used in the experimental training. In addition, all subjects experienced three 1-week experimental training periods, one for each modality, with each period including tests of immediate and delayed recall of words taught. Due to the lack of any available suitable group learning-modalities test, the author developed one which proved to be unreliable. However, further analysis indicated that the experimental training test procedure was actually itself a reliable learning-modalities test. Author-made tests, tables, and references are given. (Author/DE)

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TESTING WORD RECOGNITION AS A FUNCTION OF LEARNING MODALITY

A THESIS

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ABSTRACT

Numerous studies in the past 80 years have investigated the relative effectiveness of different sensory modalities, particularly the comparison between visual and auditory learning. The results of these studies yield no clear-cut trends, even when variations among experimental designs have been taken into consideration. Studies concerning the role of sensory modalities in the teaching of word recognition have been far less common, although equally devoid of guidance.

The purpose of the present study was to investigate whether training in word recognition based on a child's dominant sensory modality (visual, auditory, or kinesthetic) produced significantly better results than training based on non-dominant modality.

The subjects in the current study, 25 first grade children with no prior instruction in reading, were given visual, auditory, and kinesthetic modalities tests as well as a pretest of recognition of words used in the experimental training. In addition, all subjects experienced three 1-week experimental training periods, one for each modality, each period including tests of immediate and delayed recall of words taught.

A major limitation of the study was the lack of any available suitable group learning modalitites test.

This necessitated the development by the experimenter of such an instrument.

It was subsequently determined that the learning modalities test instrument developed was insufficiently reliable to permit its use to identify the dominant sensory modality of each child. Thus the original intention of the study was unable to be carried out.

However, further analysis indicated that the experimental training test procedure, originally intended to validate the learning modalities test, is actually itself a reliable learning modalities test. It can also be administered easily by a classroom teacher to large groups of children.

It therefore appears that further experimentation to validate the experimental training procedure as a learning modalities test would be warranted.

CHAPTER I

INTRODUCTION

Many educators believe that children vary in their mode of learning just as they do in their rate of learning. These educators feel that differences exist in the ability to use the various sensory modes (visual, auditory, and kinesthetic) not only among children but even within the same child at different times or in different situations. For many children, one mode of learning may prove dominant.

The importance of learning modalities with regard to reading instruction has been stressed by Singer (1966):

> If an individual with a sensory deficiency is exposed to a method of instruction which requires proficiency in that same sensory mode but is not able to compensate through a self-acquired method nor has had instruction adapted to his major mode of learning, he is likely to accumulate a disability in reading, in addition to a negative learning set in this area [p. 121].

Extending Singer's reasoning, word recognition should therefore be taught with regard to the sensory mode by which the child learns best. This idea of teaching word recognition according to the student's dominant sensory modality was, in fact, suggested as early as 1946 by Betts. Harris (1961) and Staples (1968) have also strongly

recommended this approach; however, they, like Betts, are referring to its use with students in remedial reading situations.

In 1955, Mills suggested that teaching word recognition according to dominant modality should become a regular classroom procedure, although it should be noted that the test Mills developed in connection with his work is designed for remedial reading teachers. It appears, though, that Mills's suggestion has not been widely acted upon.

Russell and Fea (1963), stating that children are visually, auditorily, or kinesthetically oriented and that the exclusive use of any one teaching method is probably unwise, suggest that perhaps teachers need diagnostic devices to determine which mode of learning is best for an individual child. In the last decade some efforts have been made in this direction, notably by Rivkind (1959), Perry (1960), and Mills (1964). As yet, however, there is no simple procedure available by which a classroom teacher can screen her students in an effort to identify individual dominant sensory modality.

If dominant modality can be identified for each individual child, as is claimed, the next logical step would appear to be the investigation of the implications of learning modality for classroom teaching, i.e., grouping

children in the classroom and instructing them in word recognition according to methods that favor their dominant sensory modes. It does not appear that this approach has yet been attempted.

Purpose

The purpose of this study was to investigate whether classroom instruction in word recognition should be based on a child's dominant learning modality. However, as a practical instrument for determining dominant modality was lacking, the first requirement of this study was the development of such a learning modalities test. Therefore, the first question undertaken to be answered was:

1. Can a reliable learning modalities test be developed which can be administered easily to groups of primary children?

If this question can be answered positively, validation of the test to answer the following question can be undertaken.

2. What are the correlations between the learning modality test scores and the experimental training test scores for each of the experimental training procedures (visual, auditory, and kinesthetic)? More specifically, will children who score high on a learning modality test achieve greater learning of word recognition when trained

in that modality as opposed to other modalities?

Secondary questions under consideration were:

3. What are the correlations between visual, auditory, and kinesthetic scores on the learning modalities tests? In other words, will children scoring high on one of the modality tests also score high on the others?

4. What are the correlations between the experimental training test scores? That is, will children who achieve well on one of the experimental training tests also achieve well on the others?

To investigate these questions, a learning modalities test was developed by the experimenter and administered to a group of first grade children. The purpose of this test was to identify each child's dominant sensory modality. All children were then exposed to three experimental training periods, each of which stressed one particular sensory mode (visual, auditory, or kinesthetic). Each experimental training period lasted 1 week and included tests of immediate and delayed recall of words learned.

Limitations

The greatest limitation was the lack of a suitable test instrument and the need to develop one for this study. Determination of whether instruction in word recognition should be based on dominant sensory modality can be made

only if such a modality can be identified reliably.

The study was concerned with group methods of instruction that teachers can employ in the classroom rather than being concerned with clinical technique.

Furthermore, the concern was with word recognition only because, as Dolch stated, word recognition is fundamental to reading, for without the right words there can be no meaning (cited in Mills, 1964).

The subjects, moreover, were children who had not been exposed to formal reading instruction in the classroom. This was done to prevent the bias of teacher-favored method of instruction since, as Cooper and Gaeth (1967) suggest, dominant modality is sometimes merely a reflection of habit, i.e., the method that the child has grown accustomed to using.

The small size of the experimental population and the brief duration of experimental training also can be considered limitations.

Definition of Terms

In this study, dominant sensory modality or dominant sensory mode is used to mean the sensory input by which an individual appears to absorb information most readily. More specifically, it refers to scores on the learning modalities test.

While it is realized that any method of teaching

word recognition involves the use of more than one sensory input, the methods used in this study were designed to stress particular sensory modes. The visual training method therefore concentrated the child's attention on looking at the word so as to obtain a visual image of it. Similarly, the kinesthetic training method used in this study stressed getting the "feel" of the word, while the auditory training method stressed hearing word sounds.

Importance of the Study

Extensive time and effort have been devoted to studying whether one method of teaching word recognition is "better" than another method. The literature is filled with research studies comparing visual, phonic, and kinesthetic methods of teaching word recognition as well as approaches that are combinations or variations of these methods, such as i.t.a.

Unfortunately, most often the results of these studies are inconclusive or inconsistent. As the Encyclopedia of Educational Research (Harris, 1960) states about the results of such research, "The safest generalization probably is that extant evidence is insufficient to establish the superiority of any single general methodology [pp. 852-853]." Despite the vast amount of research, the field of reading appears to be no closer to the answer of how best to teach reading and prevent reading failure.

The investigator suspects that perhaps a reason that the research to date has been inconclusive is that it has been concerned primarily with methods of reading instruction from a group rather than an individual point of view. A particular method is taught to an entire group, then compared with a different method taught to another group. Individual differences in dominant modality could be a factor clouding results. Therefore, in the present study an attempt is made to determine if individual differences make the difference in teaching word recognition.

CHAPTER II

REVIEW OF LITERATURE

Investigations of differences in learning resulting from emphasis on different sensory modalities appear to have been initiated in 1894 with the work of Munsterberg. In the 75 years since Munsterberg conducted his pioneer experiments, innumerable studies have investigated the area of learning by means of different sensory modalities. Most investigators, like Munsterberg, have concerned themselves with the relative effects of visual learning as opposed to auditory learning.

Taken as a whole, these studies on visual and auditory modalities are far from conclusive. The contradictory nature of the results obtained by the different investigators appear to result from variations in the nature of the learning task, the material used, and the age of the subjects. Even when these factors are taken into consideration, however, no clear-cut trends emerge.

As these studies of auditory and visual modalities are too numerous even to summarize here, and as they have limited applicability to the current study, the reader is referred to the recent comprehensive summary provided by

Balmuth (1968), the summary prepared in 1950 by Day and Beach, and the article by Kling (1968). In addition, Henmon (1912), in his review of literature, provides a good summary of the research conducted before 1912, while the Winter issues of Reading Research Quarterly (Robinson, Weintraub, & Smith, 1966, 1967, 1968, 1969) present thorough summaries of recent research in learning modalities.

The area of learning modalities is also the concern of current research; for example, an investigation of visual and auditory learning is being conducted by Staples and Barr.[1] Several universities are involved in research in this area, including Northwestern University's Institute for Language Disorders,[2] the University of Chicago,[3] and the University of Pennsylvania.[4]

The fact that the studies of learning modality, like those of word recognition, lack concensus again appears to indicate the need for studying the role of individual differences with regard to learning.

Studies involving the use of different modes of learning with regard to the teaching of word recognition

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[1]Personal communication with Joan Staples, June 20, 1969.

[2]Ibid. [3]Ibid.

[4]Personal communication with Dr. J. Wesley Schneyer, Associate Director, University of Pennsylvania Reading Clinic, February 23, 1970.

are far less common than those of auditory versus visual learning. There seems, however, to be no controversy surrounding the idea that individual children learn words differently according to the method of instruction used.

Betts stated in 1946 that children learn words best by different methods of instruction, and suggested that instructional procedures be differentiated to meet individual needs. Staples (1968) similarly declared that special modes of learning should be identified and employed in teaching reading. Harris (1961), to support his belief that children learn to recognize words differently by different methods and that instruction should be based on the method by which the individual child learns best, worked with Roswell to develop a method of using miniature sample lessons as a diagnostic procedure to determine how word recognition should be taught to individual children.

Betts, Staples, and Harris all suggested the use of individualized instruction based on mode of learning as a procedure for use with students in corrective or remedial reading situations. Singer (1966), referring to students in general, also took the position that learning to read can be facilitated by teaching methods which emphasize the strengths of the learner.

Actual experimental investigations of the relationship between sensory modalities and the teaching of

word recognition are almost nonexistent. Only three studies could be found which directly investigate this area.

In 1955, Mills conducted an experiment to determine if different children do learn words differently when taught word recognition by methods that emphasize different modalities. Mills developed a series of standardized teaching lessons in word recognition using four methods--visual, phonic, kinesthetic, and a combination of the first three. He administered this Learning Methods Test to 58 second, third, and fourth grade students. Analyzing the results according to the age and intelligence levels of the subjects, Mills found:

1. For children of low intelligence, the phonic method was least effective. The kinesthetic method was most effective in the largest number of cases, but not significantly so.

2. For children of average intelligence, the visual and combination methods proved to be about equally effective, while the kinesthetic method was the least effective.

3. For children of high intelligence, words were learned readily regardless of the method used, but the visual method did prove to be superior to the kinesthetic method.

4. For seven year olds, the visual method appeared to be the best and the kinesthetic method the poorest.

5. For eight year olds, the kinesthetic method was significantly better than the phonic method.

6. For nine year olds, no one method was outstandingly effective or ineffective.

7. In general, the higher the intelligence the more readily children learn words, but there was no consistent relationship between the two factors for the age groups studied in this experiment.

Mills concluded that since different children do learn to recognize words more effectively by different teaching methods, teachers should familiarize themselves with all methods and be versatile in their use of these methods. He suggested that a diagnostic study should be made for each individual child in order to match method with child (Mills, 1955, 1968). He concluded:

> We have theorized about individual differences for decades, but we have done little to apply this theory in teaching practice. This research indicates the need for the concentration of energies on finding out which method is best for which children rather than developing a recipe or "a best method" that will serve for all children all the time [Mills, 1968, p. 255].

In her study of readiness and method of teaching word recognition to first grade students, Perry (1960) used the auditory and visual learning methods of the Mills Learning Methods Test (see Mills, 1964). She also found

that no one method of teaching reading is best for all children, since different children learn to recognize words more effectively by different teaching methods. She further concluded that mature children with higher IQ's learn words by more than one method and retain them more readily than do less mature children with lower IQ's. The small number of subjects, 16, makes the value of this study questionable, however.

Rivkind in 1959 developed a group method of identifying the most effective method of learning words by individual children. This instrument, the Group Teaching Methods Technique, like the Mills Learning Methods Test, consists of a series of four formalized teaching lessons accompanied by testing. The methods used are the same as those used by Mills--visual, phonic, kinesthetic, and a combination of the first three. Using his technique with 91 second and third graders, Rivkind found that:

1. No one method was markedly superior over any other method. All four methods were effective for individual children.

2. Differences in teachers did not appreciably affect the results. Different teachers got comparable results using the same teaching methods.

3. The Group Teaching Methods Technique allowed teachers to select the most effective teaching method for

individual children.

4. The Technique provided a direct means for comparing learning of children by each of the four methods.

Rivkind concluded that greater flexibility is needed in the approach of teachers to the teaching of word recognition. He felt that teachers should be familiar with all methods and determine which method of instruction to use according to the needs of the individual children. In this conclusion, Rivkind agrees with Mills.

Thus the research indicates that different children learn to recognize words most effectively by different methods of instruction, and that the most effective method of teaching word recognition can be identified for individual children at primary grade levels. The use of a method of teaching word recognition that stresses the dominant modality has been recommended for all children, particularly those who have had difficulty learning to recognize words. The use of a method of teaching that emphasizes a child's dominant method of learning words has long been practiced as a clinical technique. However, it appears that its use developmentally has not been realized.

Durrell (1958) emphasized that success in the initial stages of classroom instruction is more important than providing remedy after failure has occurred. He felt that this is particularly true of reading. In

this connection Staples (1968), moreover, suggested the developmental use of differentiated instruction to prevent reading difficulties. The major question under investigation in the current study, therefore, is whether initial instruction in word recognition based on methods that emphasize an individual child's dominant modality will produce significantly better learning than methods which do not emphasize dominant modality.

The need for diagnostic devices which allow teachers to determine which method of teaching is best for an individual child was emphasized by Russell and Fea (1963), who also believed that children are auditorily, visually, or kinesthetically oriented. As discussed previously, Harris working with Roswell, as well as Mills and Rivkind have all developed techniques for identifying dominant method by which individual children learn words.

The technique of both Harris and Roswell, that of sample test lessons, which was developed as a clinical procedure, groups together methods that emphasize different modes. It also tends to be difficult to administer and is time consuming. In addition, their method is not standardized. In general, it would be difficult for a classroom teacher to use this technique with her entire class.

Mills' Learning Methods Test, while standardized

and more clear-cut than the method used by both Harris and Roswell, is designed for administration on an individual basis and requires five separate testing periods of 15 minutes daily. It has also been criticized on the basis that its selection of words for the phonics procedure is impractical (Culliton, 1968).

Rivkind's Group Teaching Methods Technique seems very promising for use by classroom teachers for identifying the dominant method of individual children for learning to recognize words, as the technique can be group administered and is not affected by teacher differences. It has one major drawback, however--it appears not to have been published.

Thus, since none of the above methods appeared practical for the current study, a group learning modalities test was developed by the experimenter.

CHAPTER III

METHOD

The experimental study consisted of three learning modalities tests, a pretest of recognition of words to be used in the teaching procedure, and three experimental training periods, each with accompanying tests of recall. These procedures and the experimental population will be described in the following discussion.

Subjects

The subjects were 47 first grade students of the Cranbury School in Cranbury, New Jersey. The students composed two regular first grade classes of 19 children each and a special "pre-first" class of 9 children.

The results of 25 of the 47 children in the three first grade classes were selected for analysis. Four children were eliminated because of absence; four children because they already knew most of the words selected for the experimental training; one child because he transferred to one of the first grade classes part way through the experiment; and thirteen children because their tests were unscorable. In the latter group was the entire population of the pre-first grade class. These children had

extremely short attention spans and were unable to concentrate during the testing and experimental training. During testing the children consistently marked words in the first column only, without waiting for the test words to be pronounced by the examiner. The children in the pre-first grade class were dropped from the experiment after participating in the learning modalities testing, the pretest of word recognition, and the experimental auditory training.

The school, located in a rural area in central New Jersey, is a small one, consisting of approximately 470 students in a Kindergarten-to-eighth grade grouping. The subjects represented the entire first grade population.

The town itself has a relatively stable population of about 3,000. The parents are, in general, self-employed small businessmen, farmers, or are employees of farms or greenhouses in the area. Most families own their own homes.

The children participating in the experiment ranged in age from 5.11 to 7.0, with the mean age being 6.5. Mean IQ, as measured by the total score on the California Short Form Test of Mental Maturity, was 115, with the scores ranging from 88 to 142.

Group Learning Modalities Test

The students were tested initially to determine dominant mode (visual, kinesthetic, or auditory) of learning to recognize words. Administered to each class separately, the testing procedure was a group learning modalities test developed by the experimenter. All teaching and testing was done by the investigator.

The group learning modalities test consisted of three lists of five consonant-vowel-consonant nonsense words each, written in Paul McKee's symbol orthography (1966). Words were written in one-quarter-inch thick, 4 inch high lettering on 6-by-12 inch oaktag cards. In addition, illustrations used in the visual procedure were line drawings on 8 inch square cards. The drawings used to illustrate the words for the visual modality test are shown in Figure 1.

The three groups of words were presented to the children in three separate 5-minute sessions of the three succeeding days from September 8 to September 10, 1969. The balanced order presentation used is shown in Figure 2. The words used in each of the procedures are given in Figure 3. The exact procedures used in presenting the words were as follows.

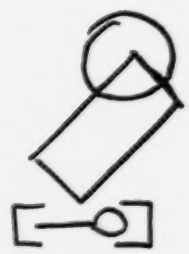
Visual modality test. A picture-word card was shown to the subjects. The children were told to take a

Figure 1

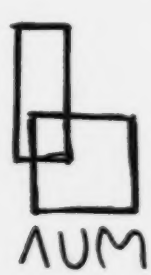
ILLUSTRATIONS USED IN THE VISUAL MODALITY TEST

(rab)*

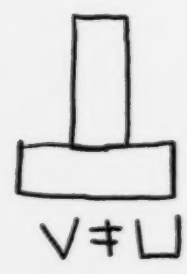
(nem)



(huk)



(tig)



(lod)

*Words in parentheses are the pronunciations.

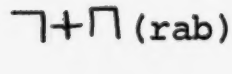
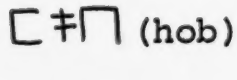
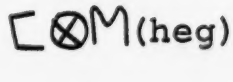
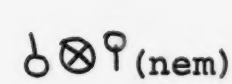
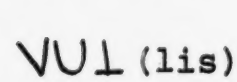
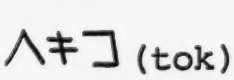
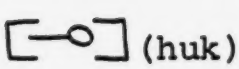
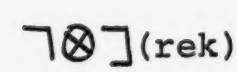
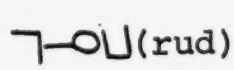
Figure 2

ORDER OF PRESENTATION OF THE GROUP
LEARNING MODALITIES TEST

Class 1	Visual	Kinesthetic	Auditory
Class 2	Kinesthetic	Auditory	Visual
Class 3	Auditory	Visual	Kinesthetic

Figure 3

WORDS USED IN THE GROUP LEARNING MODALITIES TEST

Visual	Kinesthetic	Auditory
 (rab)*	 (hob)	 (heg)
 (nem)	 (lis)	 (tok)
(huk)	(rek)	(rud)
 (lod)	 (tud)	 (was)
(tig)	(cam)	(nib)

*Words in parentheses are the pronunciations.

good look at the word and to try to remember it. This procedure was repeated for each of the other words.

The picture word cards were run through two more times, thus providing three 20-second exposures for each picture-word card.

Kinesthetic modality test. A rexographed sheet containing the first word, written in 3 inch high symbols, was given to each child and the children were told the word. The subjects were then told to take their index fingers and "trace" the word on the sheet, thinking the word to themselves as they traced it. The children were then directed to take their pencils and trace the word, thinking it to themselves as they traced. Tracing in pencil was repeated another time on the same copy. The subjects were required to trace rather than copy the word because it was felt that in the early weeks of first grade tracing would be a less difficult task, yet would provide the kinesthetic "feedback" associated with this method. Copies of these sheets are shown in Appendix II.

After the word was traced, the rexographed copies were collected. The same teaching procedure was repeated for each of the other four words, providing three 20-second exposures for each word.

During distribution the children were instructed to close their eyes. When all children had the word

sheets face up on their desks, the class was instructed to open their eyes and tracing was begun. The first word sheets were collected while the second set was distributed, and so on.

Auditory modality test. The subjects were shown a word written in 4 inch high letters on a 6-by-12 inch card. They were directed to listen carefully to the word and to try to remember it. The word was said once and then repeated at 5-second intervals for a total of 20 seconds.

This procedure was repeated for each of the other four words. After all five words were presented, the entire group of words was run through again, one at a time, two more times, thus providing three 20-second exposures for each word.

Testing of recall. After each of the three modality tests, the subjects were administered tests of immediate and delayed recall of the words taught. Immediately after teaching, the children were given rexographed test sheets (see Appendix I). The words were pronounced one at a time and the students were asked to put an "X" on the correct word on the answer sheet. One hour later a different form of the test was given to the subjects.

Pretest of Word Recognition

A pretest of 50 words (see Appendix III) was presented to the children to determine knowledge of words to be used in the experimental teaching procedure. The words, written in traditional orthography, were common nouns selected from the first grade books of the Scott, Foresman and Ginn basal reading series, which are currently in use in the first grades of the Cranbury School.

The pretest, administered by the investigator to each class separately, lasted 10 minutes.

Three lists of 15 words each were selected from the pretest words. These lists of words used in the experimental training appear in Figure 4. The pretest of word recognition was administered on September 12, 1969.

Experimental Training Procedure

The experimental training consisted of three 1-week periods of instruction, one for each method. During each period the children received four daily 15-minute instructional sessions and one testing period of approximately 5 minutes. Copies of the tests appear in Appendix IV. The training took place in the 3 weeks from September 15 to October 3, 1969.

The method of teaching essentially followed the pattern used in the group learning modalities test. The

Figure 4

WORDS USED IN THE EXPERIMENTAL TRAINING*

Visual	Kinesthetic	Auditory
ball	food	hand
car	box	apple
book	kitten	pet
dog	party	dinner
house	farm	park
hat	game	fire
girl	day	rain
horse	bird	man
train	yard	baby
wagon	clown	duck
cake	head	puppy
school	store	story
chair	mouse	bread
tree	home	boat
paint	truck	toys

*Words omitted (randomly) were hair, animal, mill, street, and basket.

order of presentation of the teaching methods is shown in Figure 5.

In contrast to the group learning modalities test, five words were presented on each of the first 3 days of the training period and all 15 words were reviewed on the fourth day. In kinesthetic experimental training, individual word cards to be traced were given to the children, five each day for 3 days. On the fourth (review) day, three sheets stapled together and containing all 15 words were distributed and traced one by one. (See Appendix V for kinesthetic experimental training tracing sheets.) Testing for all experimental training periods was accomplished by means of a rexographed word recognition test (see Appendix IV). Immediate recall was checked directly after the review session on the fourth day. The test of delayed recall was administered on the fifth day of the training period, approximately 24 hours after the test of immediate recall.

As with the group learning modalities test and the pretest of word recognition, all teaching and testing was done by the experimenter. Each class was taught and tested separately.

Special Features of Materials Used

Since the subjects were first grade children with little test experience, certain features were incorporated

Figure 5

ORDER OF PRESENTATION OF THE EXPERIMENTAL TRAINING METHODS

Class 1	Kinesthetic	Auditory	Visual
Class 2	Auditory	*	*
Class 3	Visual	Kinesthetic	Auditory

*Dropped from experiment.

to make testing easier. All tests included simple pictures (a bat and ball, a car, an ice-cream cone, etc.) in the left-hand margin as a means of helping the children keep their place. In addition, all words were boxed off to help the children see them as separate units. Also, kinesthetic modality tracing sheets, individual kinesthetic experimental training sheets, and all modality tests contained faces in the upper left hand corner. This was done to insure that the children held the papers correctly--they were instructed that if the face was smiling at them, the paper was being held correctly. (See Appendixes I through V.)

The three pages of words used for kinesthetic experimental training review had the words, five to a page, boxed off and with pictures in the left hand column, also to help the children keep their places.

A primary typewriter was used to type the tests; therefore, all printing (e.g., on the word cards) duplicated the primary type--the letters "a," "g," "t," etc.--to prevent the confusion of having word cards in manuscript print and tests in primary type.

CHAPTER IV

RESULTS AND DISCUSSION

This chapter presents a summary of results based on the raw scores on the learning modalities test and those of the experimental training tests. A discussion of these results will also be included in this chapter.

Group Learning Modality Test

Reliability was measured by coefficients of stability, and internal consistency was found as follows. The coefficients of stability were computed, by means of product-moment correlation, by comparing each five-item modality test (visual, auditory, and kinesthetic) of immediate recall with its corresponding test of delayed recall. The resulting coefficients were .39 for the visual modality, .21 for the auditory modality, and .25 for the kinesthetic modality.

The coefficients of internal consistency were computed (also by means of product-moment correlation) by considering each test of immediate recall and its corresponding test of delayed recall as one ten-item test and using the split half method (corrected by means of the Spearman-Brown formula for full test reliability). The

coefficients found were .33 for the visual modality, .68 for the auditory modality, and .47 for the kinesthetic modality.

The coefficients of stability and the coefficients of internal consistency are summarized in Table 1.

The low reliability coefficients, especially the coefficients of stability, were felt to be in good part a function of the length of the tests, five items. Therefore, the Spearman-Brown formula was applied to predict what the coefficients of stability might have been had the tests been longer. The resulting predictions of coefficients for tests two, three, and four times longer are given in Table 2. Had the tests been 15 or 20 items long, they probably would have been considerably more reliable.

Comparison of Modality Test and Experimental Training Test Scores

The original intention of the study was to compare scores after experimental training with scores on the learning modalities tests to determine if children do learn words best when taught by a method which stresses their dominant sensory modality. The low reliability coefficients of the learning modalities tests, however, do not permit such a comparison. An unreliable test does not permit consideration of validity.

Possible explanations for the low reliability

TABLE 1

RELIABILITY COEFFICIENTS FOR THE LEARNING MODALITIES TESTS

N = 25

Type of reliability	Visual modality test	Auditory modality test	Kinesthetic modality test
Coefficient of stability[a]	.39	.21	.25
Coefficient of internal consistency[b]	.33	.68	.47

[a]Test-retest using tests of immediate and delayed recall--five items each.

[b]Split half method using the total of the tests of immediate and delayed recall--total of 10 items.

TABLE 2

SPEARMAN-BROWN PREDICTIONS OF COEFFICIENTS OF STABILITY FOR THE LEARNING MODALITIES TESTS

N = 25

	Visual modality test	Auditory modality test	Kinesthetic modality test
Actual reliability, 5 items	.39	.21	.25
Predicted reliability, 10 items	.56	.35	.40
Predicted reliability, 15 items	.66	.44	.50
Predicted reliability, 20 items	.72	.51	.57

coefficients, other than the small number of test items, could be the orthography used and the nature of the experimental population.

Nonsense words written in McKee's (1966) symbol orthography were used as a means of equalizing the experience of the students and preventing bias. However, it would appear that if a determination of how well children learn to recognize real words written in traditional orthography is to be made, real words in traditional orthography should be used. A list of words from second or third grade level books could have been used to control for prior knowledge.

A complicating factor in this study was the skewed nature of the experimental population. An examination of the IQ scores of the 25 subjects whose results were selected for analysis revealed that the children were above average in ability. With the exception of one score, an 88, all IQ scores were 100 or above, with nine scores being above 120. This abnormal distribution is most likely to have affected the results.

Because the Spearman-Brown predictions suggested that a longer test would have been more reliable, and because it was felt that real words written in traditional orthography might have produced more reliable results, it was decided to view the experimental training procedure

as a modality test rather than, as originally intended, the validation of a procedure.

Reliability of the Experimental Training Test

Coefficients of stability were computed for the visual, auditory, and kinesthetic experimental training tests by means of product-moment correlations, using the 15-item tests of immediate and delayed recall for each modality. In addition, three sets of coefficients of internal consistency were calculated, each involving the split half method corrected by means of the Spearman-Brown formula for full test reliability. Using product-moment correlations, reliability coefficients were computed as follows:

a) for each 15-item test of immediate recall
b) for each 15-item test of delayed recall
c) for the sum of the tests of immediate and delayed recall (making a 30-item test).

The resulting reliability coefficients are shown in Table 3. With the exception of the coefficient of stability for the kinesthetic experimental training test and the coefficients of internal consistency for all three experimental training tests, the reliability coefficients for the experimental training tests were generally high.

TABLE 3

RELIABILITY COEFFICIENTS FOR THE EXPERIMENTAL TRAINING TESTS

N = 25

Type of reliability	Visual training test	Auditory training test	Kinesthetic training test
Coefficient of stability[a]	.80	.84	.64
Coefficient of Internal consistency--total score[b]	.87	.86	.82
Coefficient of internal consistency--immediate recall[c]	.82	.84	.72
Coefficient of internal consistency--delayed recall[d]	.65	.56	.41

[a]Test-retest using tests of immediate and delayed recall--15 items each.

[b]Split half using the total of the tests of immediate and delayed recall--total of 30 items.

[c]Split half using the test of immediate recall--15 items.

[d]Split half using the test of delayed recall--15 items.

A possible explanation for the comparatively low coefficient of stability for the kinesthetic experimental training test is that the children had relatively undeveloped kinesthetic memory and forgetting was greater than with the other two methods, i.e., the children have had much experience with visual and auditory memory training and relatively little with kinesthetic memory training. In kinesthetic training the children were required to trace words to get their "feel." This is not a common procedure for these children. For many, if not most, of the children, this was possibly their first experience with kinesthetic training.

Memory, or rather forgetting, also probably accounted for the low reliability coefficients computed for the tests of delayed recall. These tests took place 24 hours after the tests of immediate recall and probably allowed memory to play a greater part than had the delay been shorter.

Intercorrelations of the Learning Modality Test Scores

The intercorrelations among the visual, auditory, and kinesthetic learning modalities tests were generally low, as might be expected from the low reliability coefficients. The auditory and visual learning modalities tests did correlate moderately; however, the

methods used in this study for teaching words aurally and visually were somewhat similar, perhaps resulting in the comparatively high correlations as compared to the other correlations.

Intercorrelations of the Experimental Training Test Scores

Intercorrelations among the visual, auditory, and kinesthetic experimental training tests were moderate and showed statistical significance at the .05 level of confidence. This is shown in Table 4. The intercorrelations among the experimental training tests were higher than those of the learning modalities tests, but this could be a result of the greater length of the experimental training tests and their employment of real words written in traditional orthography.

In general, children scoring high on one experimental training test also scored high on both of the others. It is believed that this results from the previously mentioned high ability level of the experimental population. Mills (1955) found that children of high intelligence learned words readily, regardless of the method used. Perry (1960) similarly found that mature children with high IQ's learned words by more than one method and retained them longer than less mature children with lower IQ's. In addition, Henmon's (1912) and Many's

TABLE 4

CORRELATIONS AMONG VISUAL, AUDITORY, AND KINESTHETIC EXPERIMENTAL TRAINING TESTS[a]

N = 25

Test	Visual training test	Auditory training test	Kinesthetic training test
Visual training	---	.47*	.40*
Auditory training	.47*	---	.46*
Kinesthetic training	.40*	.46*	---

[a]Using total raw score--combination of scores on the tests of immediate and delayed recall.

*$p < .05$.

(1965) findings both indicate that superiority in one mode correlated highly with superiority in another.

CHAPTER V

CONCLUSIONS

The original intention of this study, to determine if training in word recognition based on dominant sensory modality produces greater achievement than training based on non-dominant modalities, could not be realized. The learning modalities test instrument developed for this study was not sufficiently reliable to be used to identify dominant sensory modality.

Predictions of reliability of the test instrument, if extended to greater length, and low intercorrelations between the visual, auditory, and kinesthetic parts of this test can be taken to indicate the possibility that, with modifications, this instrument might be used to identify dominant sensory modalities.

However, viewing the experimental training procedure in terms of its use as a learning modality test appears to offer greater possibilities. Its greater length and its use of real words written in traditional orthography could be factors contributing to its generally high reliability and therefore its usefulness as a screening instrument.

The experimental training procedure used as a learning modality test would be easily administered and could be handled by the regular classroom teacher. Furthermore, it could be administered during the first few weeks of school before most teachers begin formal reading activities. It could also possibly be administered during the final weeks of kindergarten, although this would have to be checked by further experimentation.

In future research, however, the tests of delayed recall might possibly be eliminated, since they were only moderately reliable and did not add much to the reliability of the total test scores. The tests of immediate recall would be used alone. The use of this experimental training test procedure does appear to warrant further research, as there is now a dearth of such learning modalities tests available to the classroom teacher for group administration. The high reliabilities found by this study for the experimental training tests indicate that it has definite possibilities and seems worth validating on a large, normally distributed population.

While research on learning modalities has been conducted for many years and is continuing to be the concern of current experimentation, not that much is really known about the influence of modalities on learning to read. It is very possible that future research may show

that not enough of a difference exists to warrant training based on modalities. Furthermore, training procedures based on separate modalities may prove to be unfeasible.

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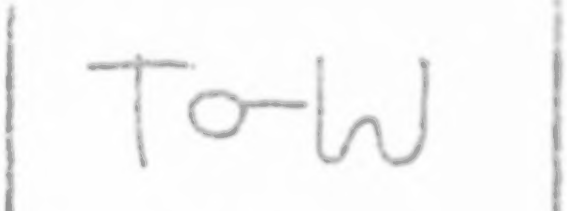
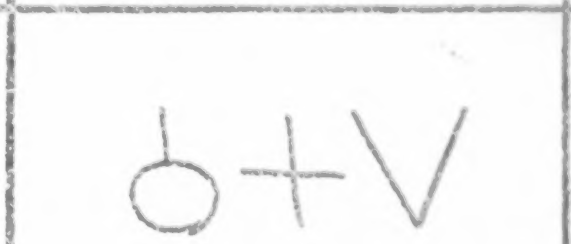
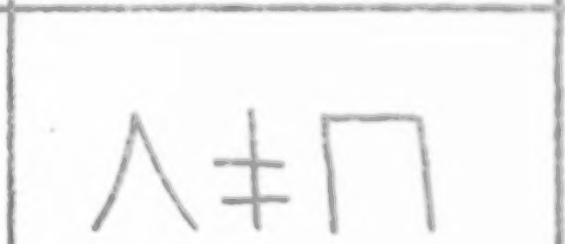
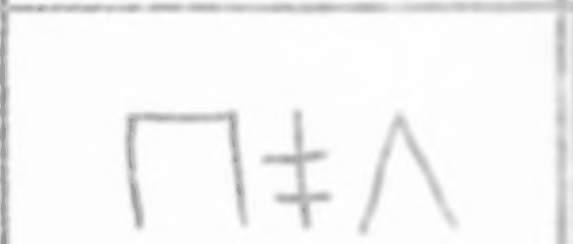
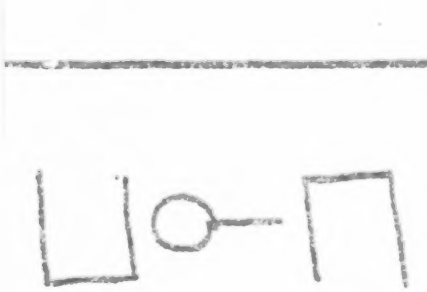
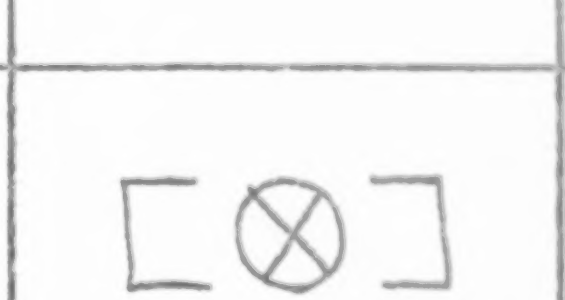
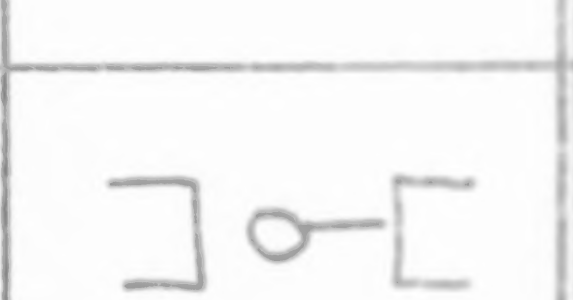
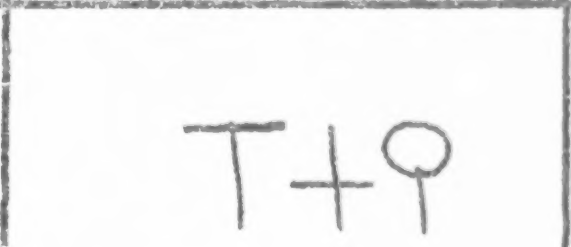
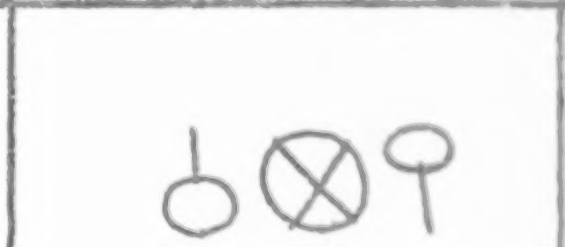
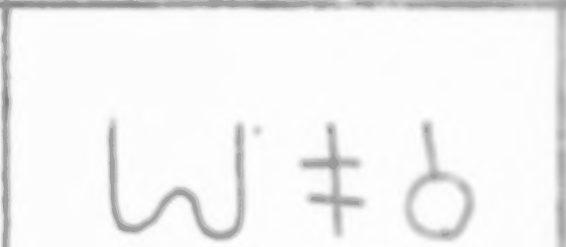
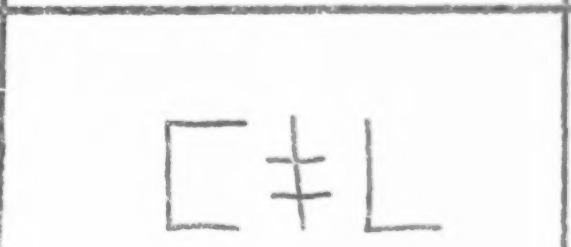
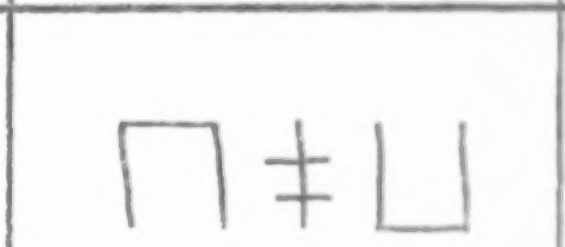
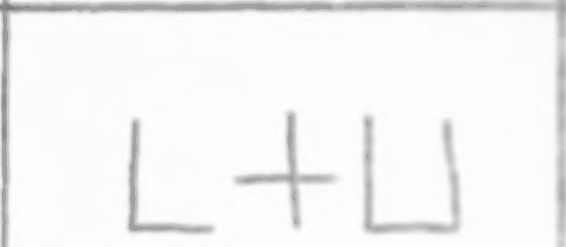
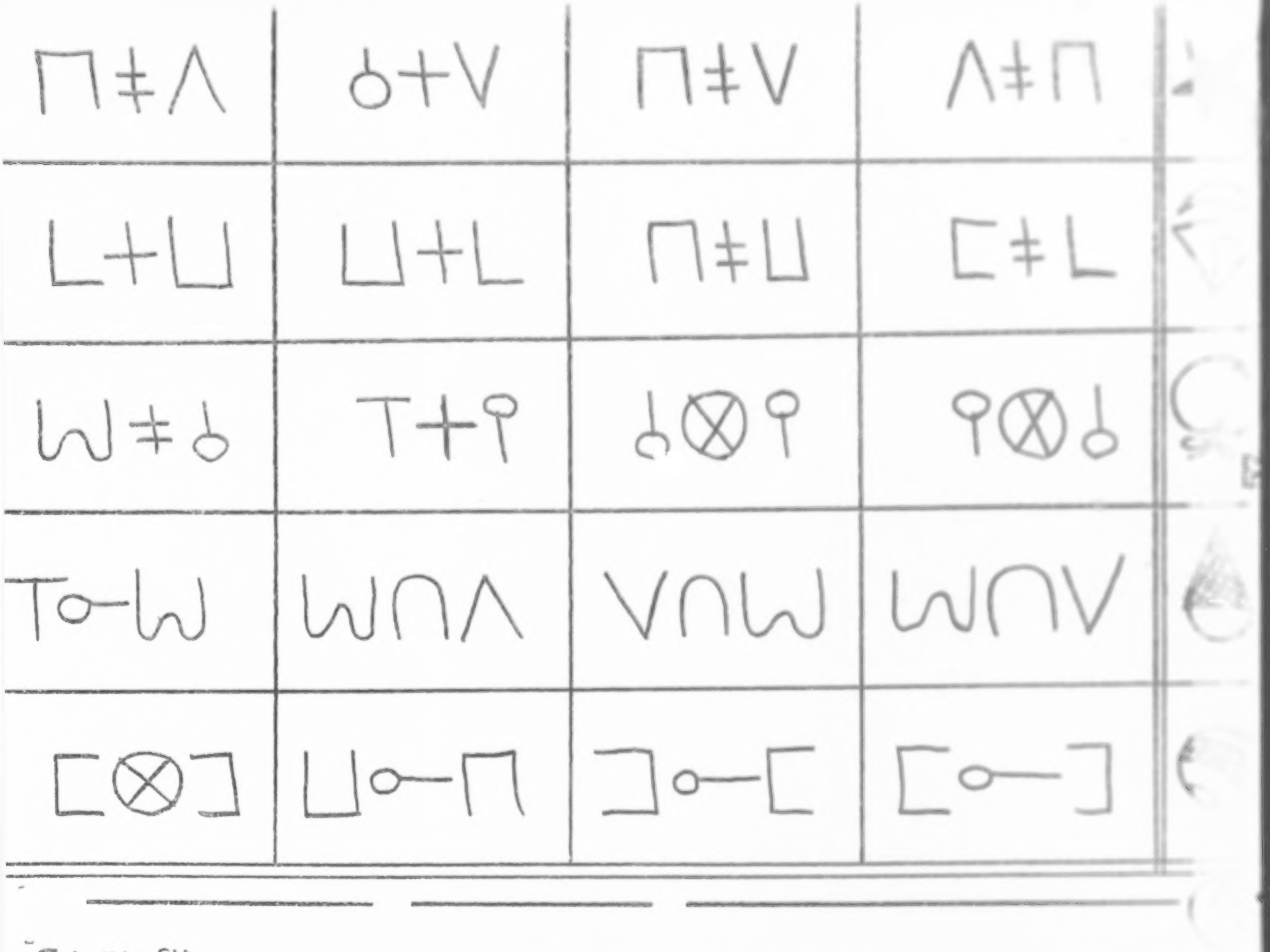
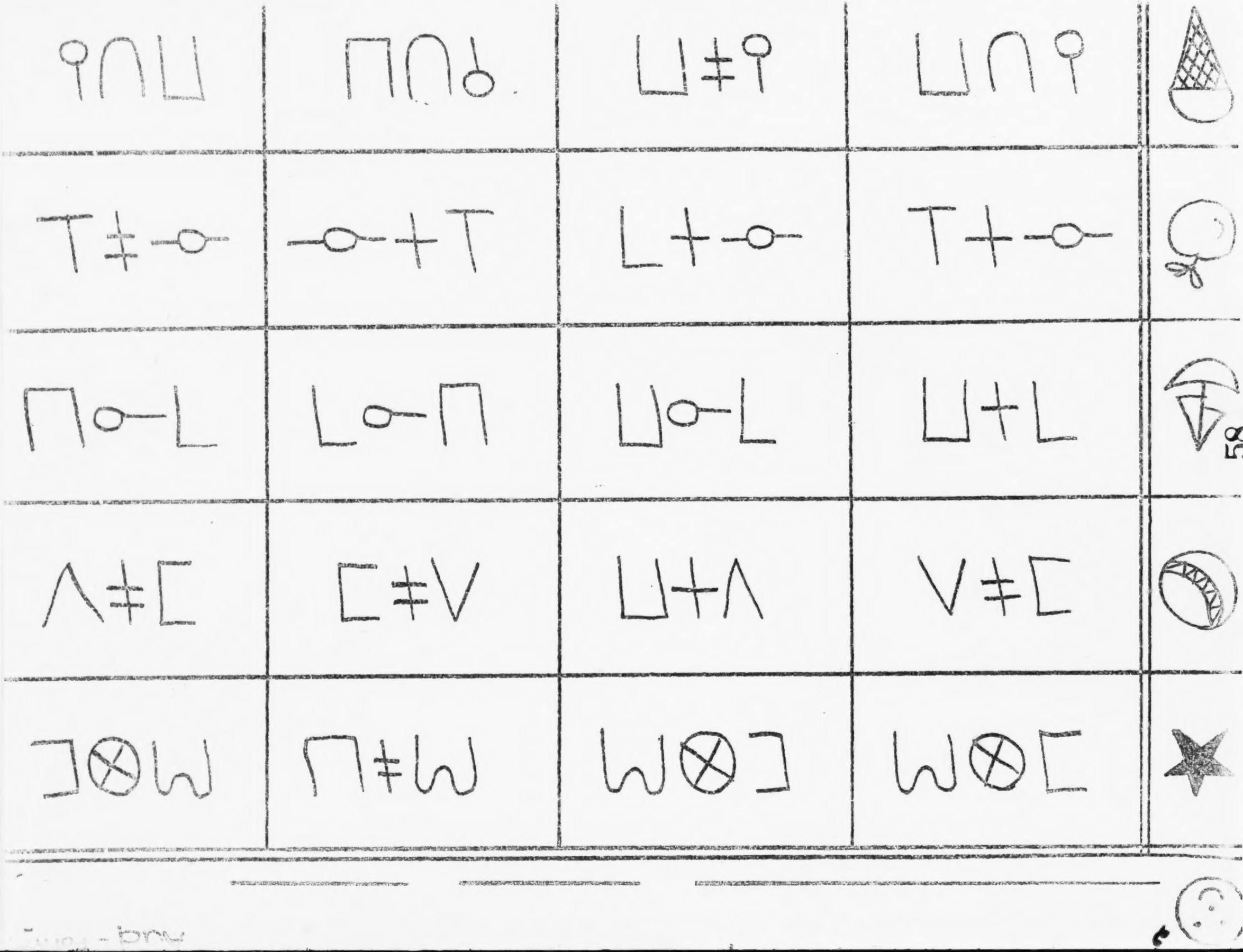
APPENDIX I

VISUAL, AUDITORY, AND KINESTHETIC MODALITY TESTS

(IMMEDIATE AND DELAYED RECALL)





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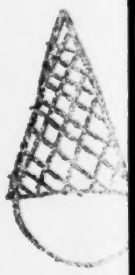
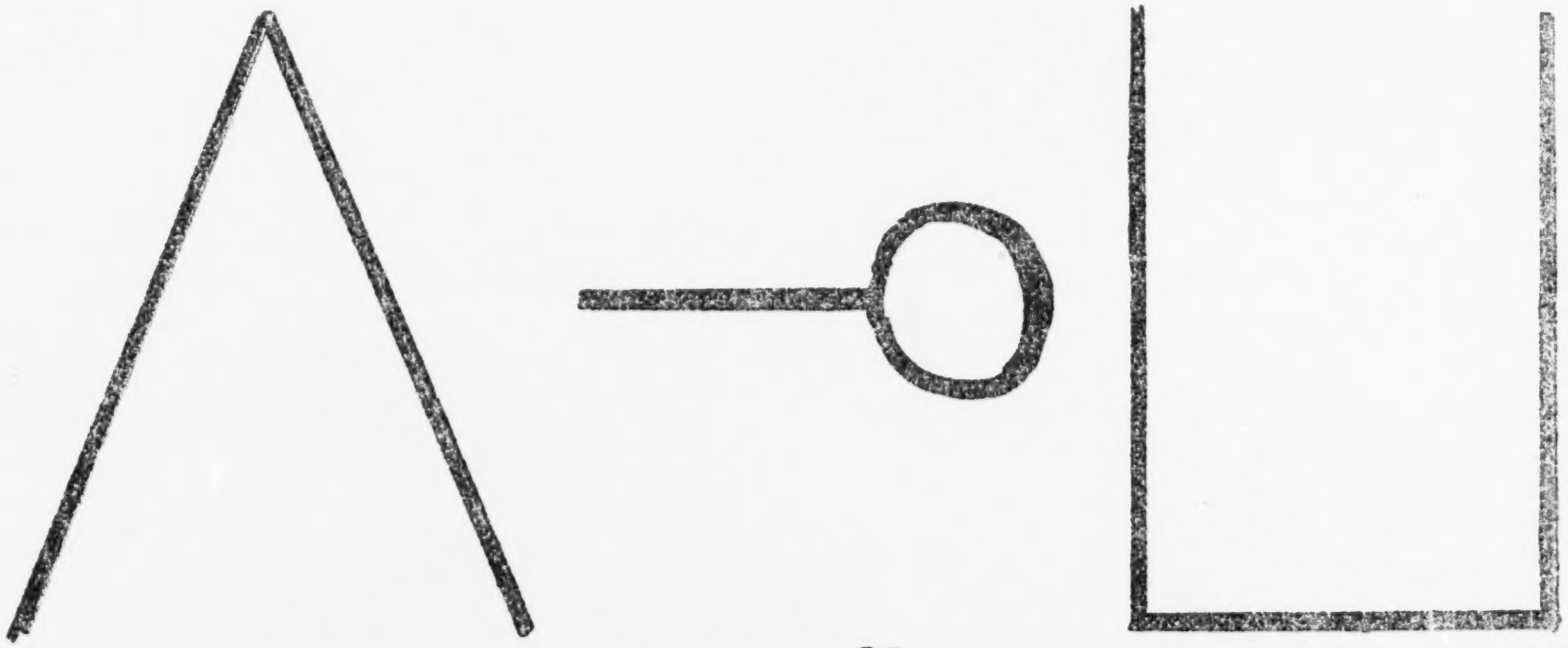
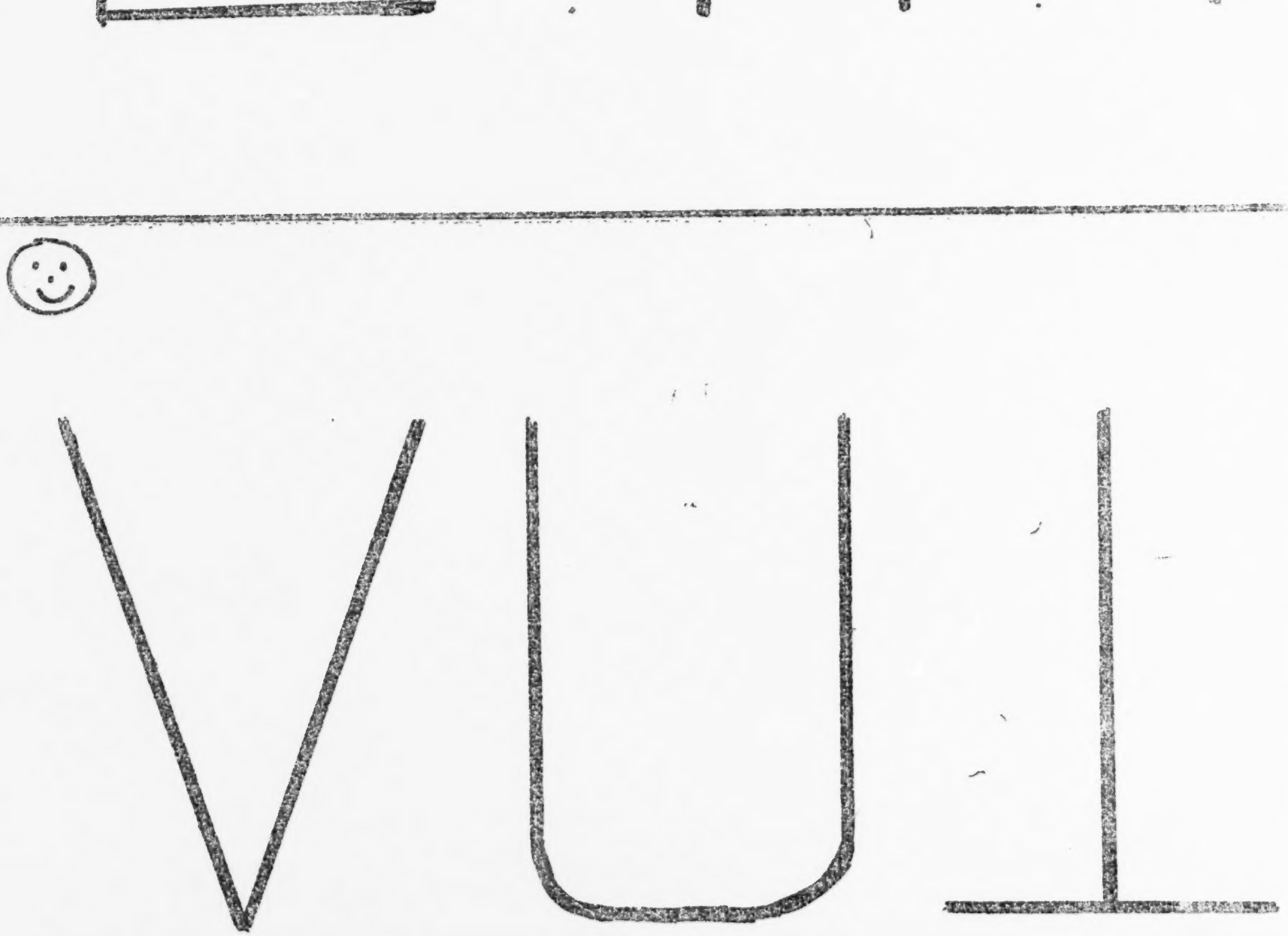
∧ǂ⊐	L+V	⊐ǂ⊔	⊔ǂ⊐	
⊤+⊔	o+X	⊏ǂX	X+o	
Vo–⊓	⊏o–X	⊓o–V	⊓+V	

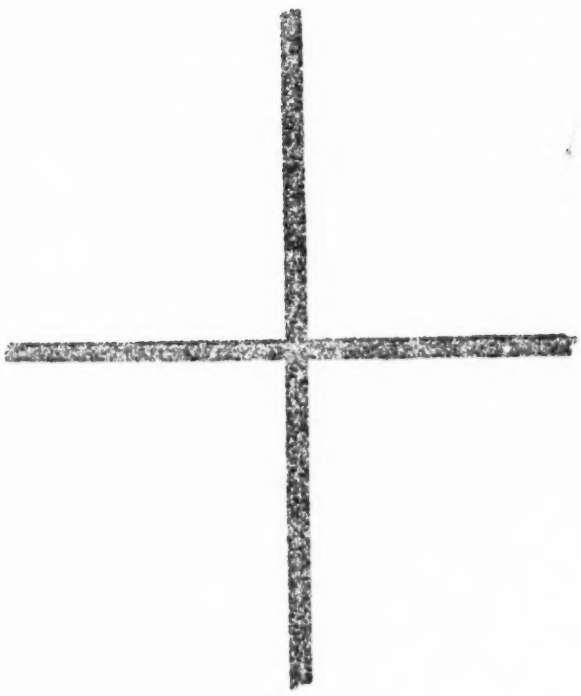
				

APPENDIX II

KINESTHETIC MODALITY TRACING SHEETS





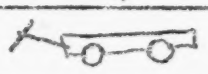
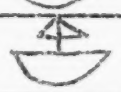
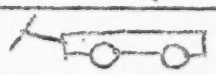


APPENDIX III

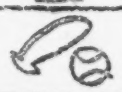
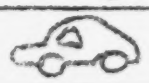
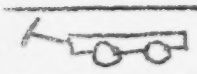
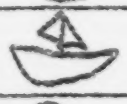
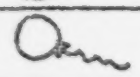
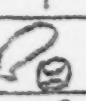
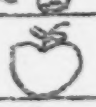
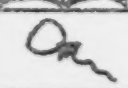
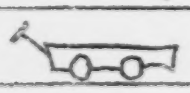
PRETEST OF WORD RECOGNITION

Word Recog. Test

Name _____ Date _____

	food	train	mill	farm
	boat	story	basket	school
	head	farm	yard	girl
	hair	wagon	hat	horse
	clown	ball	game	dinner
	paint	dinner	party	baby
	puppy	store	bread	paint
	truck	kitten	mouse	head
	horse	game	hair	mouse
	cake	clown	farm	house
	pet	car	dog	park
	wagon	man	book	animal
	pet	park	day	party
	party	story	paint	yard
	bread	animal	rain	game
	ball	street	baby	man
	fire	toys	girl	cake
	game	hand	food	head
	fire	home	mill	ball
	day	puppy	dog	kitten
	truck	paint	car	train
	box	home	rain	house
	store	school	mill	street
	tree	dinner	apple	park
	book	house	day	box

Name _____

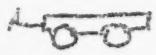
	hat	toys	farm	truck
	bird	rain	basket	boat
	duck	car	hair	dog
	story	rain	pet	hat
	wagon	clown	store	box
	day	book	bread	tree
	clown	girl	street	cake
	baby	hat	hair	pet
	box	train	dinner	book
	home	street	yard	tree
	chair	wagon	home	yard
	food	mouse	man	duck
	duck	story	dog	girl
	toys	hand	school	puppy
	apple	school	bird	fire
	mouse	animal	house	puppy
	party	train	chair	hand
	baby	kitten	bird	fire
	store	ball	tree	apple
	park	bread	boat	mill
	chair	horse	car	basket
	apple	animal	horse	toys
	man	duck	hand	food
	bird	kitten	cake	basket
	head	boat	truck	chair

APPENDIX IV

VISUAL, AUDITORY, AND KINESTHETIC EXPERIMENTAL TRAINING TESTS (IMMEDIATE AND DELAYED RECALL)

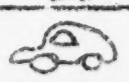
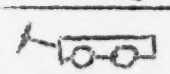
Vis - Form A

Name _____ Date _____

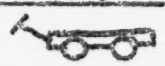
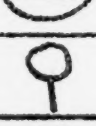
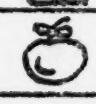
	hat	ball	dog	car
	paint	train	house	chair
	tree	horse	school	wagon
	train	girl	tree	hat
	house	paint	train	school
	horse	chair	paint	house
	book	girl	ball	cake
	cake	dog	wagon	car
	train	book	paint	tree
	dog	hat	cake	horse
	chair	tree	school	cake
	girl	wagon	car	book
	car	horse	girl	dog
	wagon	ball	hat	house
	school	book	chair	ball

Vis - Form B

Name _____ Date _____

	car	girl	book	wagon
	cake	hat	horse	dog
	house	ball	hat	wagon
	ball	chair	book	school
	girl	car	dog	horse
	tree	school	horse	wagon
	hat	ball	car	dog
	paint	school	train	house
	train	girl	tree	hat
	house	chair	paint	train
	chair	cake	school	tree
	paint	horse	house	chair
	book	ball	girl	cake
	tree	book	paint	train
	car	dog	wagon	cake

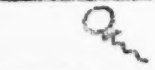
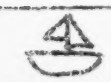
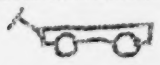
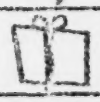
Name _____ Date _____

	man	dinner	apple	bread
	fire	park	story	pet
	toys	baby	duck	dinner
	rain	hand	fire	toys
	park	puppy	hand	bread
	man	dinner	rain	fire
	boat	puppy	baby	apple
	story	hand	duck	man
	duck	pet	boat	apple
	apple	puppy	dinner	rain
	pet	fire	story	park
	boat	bread	hand	baby
	toys	puppy	boat	man
	story	toys	bread	duck
	park	rain	pet	baby

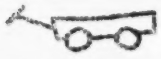
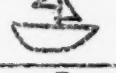
Name _____ Date _____

	dinner	baby	toys	duck
	park	bread	hand	puppy
	duck	apple	boat	pet
	boat	hand	baby	bread
	man	boat	toys	puppy
	rain	dinner	fire	man
	man	apple	bread	dinner
	park	baby	pet	rain
	story	toys	duck	bread
	pet	fire	park	story
	hand	duck	story	man
	baby	boat	puppy	apple
	fire	park	pet	story
	apple	rain	dinner	puppy
	toys	fire	hand	rain

Name _____ Date _____

	yard	food	game	home
	game	home	store	party
	box	kitten	day	head
	day	bird	party	clown
	truck	store	clown	bird
	farm	food	head	truck
	clown	truck	bird	mouse
	yard	box	food	day
	mouse	game	store	clown
	home	party	mouse	food
	party	day	box	yard
	head	mouse	truck	farm
	farm	home	head	kitten
	yard	kitten	game	bird
	store	box	kitten	farm

Name _____ Date _____

	farm	head	truck	food
	party	day	yard	box
	store	clown	game	mouse
	home	kitten	head	farm
	truck	bird	clown	store
	party	store	home	game
	kitten	game	bird	yard
	mouse	truck	head	farm
	yard	food	game	home
	box	kitten	day	head
	truck	bird	mouse	clown
	mouse	home	party	food
	box	farm	store	kitten
	clown	party	bird	day
	day	box	yard	food

APPENDIX V

KINESTHETIC TRAINING TRACING SHEETS

food

box

kitten

party

farm

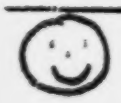
game

day

bird

yard

clown



head

store

mouse

home

truck

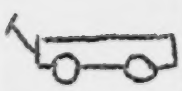
Name _____

food

box

kitten

party



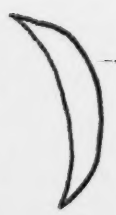
farm

game

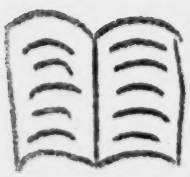
day

bird

yard



clown

	head
	store
	mouse
	home
	truck

APPENDIX VI

RAW SCORES FOR THE LEARNING MODALITIES TESTS, THE PRETEST OF WORD RECOGNITION, AND THE EXPERIMENTAL TRAINING TESTS

TABLE 6

RAW SCORES FOR THE PRETEST OF WORD RECOGNITION AND THE LEARNING MODALITY TESTS

Subject	Word recognition pretest[a]	Modality tests								
		Visual			Auditory			Kinesthetic		
		I	D	T[b]	I	D	T	I	D	T
B. B.	15	1	1	2	0	1	1	1	2	3
J. C.	13	3	2	5	0	0	0	2	1	3
J. D.	11	1	1	2	2	3	5	2	0	2
D. H.	7	1	1	2	0	4	4	1	0	1
M. H.	9	1	1	2	0	2	2	0	1	1
D. L.	7	2	2	4	2	2	4	1	0	1
J. M.	11	0	3	3	1	4	5	1	2	3
K. O.	9	1	1	2	1	1	2	2	1	3
J. S.	3	0	3	3	0	1	1	0	2	2
B. S.	12	1	2	3	0	2	2	1	0	1
F. S.	14	3	1	4	2	2	4	1	1	2
K. S.	7	1	2	3	2	2	4	0	0	0
M. A.	18	1	4	5	1	1	2	1	2	3
C. A.	15	1	2	3	1	1	2	0	1	1
T. C.	15	2	2	4	2	1	3	3	1	4
M. C.	24	4	3	7	4	1	5	1	2	3
T. D.	9	1	0	1	1	0	1	0	2	2
J. E.	12	0	0	0	0	0	0	0	0	0
E. F.	18	3	1	4	4	3	7	2	3	5
J. H.	17	5	3	8	2	1	3	2	1	3
C. K.	18	1	1	2	0	1	1	2	3	5
K. M.	17	3	3	6	3	2	5	2	0	2
M. O.	9	0	3	3	2	0	2	0	1	1
D. P.	10	1	0	1	0	0	0	2	3	5
J. S.	12	1	1	2	1	1	2	1	1	2
Mean	12.5	1.5	1.7	3.2	1.2	1.4	2.7	1.1	1.2	2.3

[a]Range is from 0 to 45.

[b]I = test of immediate recall.
D = test of delayed recall after 1 hour.
T = sum of scores on tests of immediate and delayed recall.
Range on I and D is from 0 to 5.
Range on T is from 0 to 10.

TABLE 7

RAW SCORES FOR THE EXPERIMENTAL TRAINING TESTS

Subject	Experimental training tests								
	Visual			Auditory			Kinesthetic		
	I	D	T[a]	I	D	T	I	D	T
B. B.	2	3	5	9	5	14	3	6	9
J. C.	3	7	10	6	8	14	2	6	8
J. D.	4	3	7	3	5	8	3	4	7
D. H.	5	3	8	5	5	10	1	5	6
M. H.	6	5	11	8	5	13	6	3	9
D. L.	4	4	8	5	8	13	6	4	10
J. M.	7	4	11	6	6	12	4	2	6
K. O.	4	1	5	5	7	12	3	2	5
J. S.	3	2	5	3	2	5	4	4	8
B. S.	3	3	6	0	2	2	6	3	9
F. S.	5	6	11	6	7	13	4	6	10
K. S.	2	6	8	3	5	8	4	3	7
M. A.	3	10	13	9	7	16	4	6	10
C. A.	2	4	6	8	8	16	5	7	12
T. C.	5	4	9	5	4	9	6	2	8
M. C.	13	14	27	14	15	29	11	12	23
T. D.	2	3	5	3	5	8	6	5	11
J. E.	6	4	10	8	8	16	4	3	7
E. F.	7	8	15	4	5	9	7	3	10
J. H.	8	9	17	11	9	20	8	4	12
C. K.	12	11	23	12	12	24	12	10	22
K. M.	4	4	8	7	8	15	11	7	18
M. O.	6	7	13	7	5	12	3	3	6
D. P.	4	0	4	3	10	13	2	2	4
J. S.	5	4	9	4	1	5	5	4	9
Mean	5.0	5.2	10.2	6.2	6.5	12.6	5.2	4.6	9.8

[a]I = test of immediate recall.
D = test of delayed recall after 24 hours.
T = sum of scores on tests of immediate and delayed recall.
Range on I and D is from 0 to 15.
Range on T is from 0 to 30.